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GUAM AGRICULTURAL EXPERIMENT STATION,
J. B. THOMPSON, Special Agent in Charge.

ANNUAL REPORT OF
THE GUAM
AGRICULTURAL EXPERIMENT STATION
FOR 1912.

UNDER THE SUPERVISION OF
OFFICE OF EXPERIMENT STATIONS,
U. S. DEPARTMENT OF AGRICULTURE.

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GUAM AGRICULTURAL EXPERIMENT STATION, ISLAND OF GUAM.

[Under the supervision of A. C. TRUE, Director of the Office of Experiment Stations,
United States Department of Agriculture.]

WALTER H. EVANS, *Chief of Division of Insular Stations, Office of Experiment Stations.*

STATION STAFF.

JOHN B. THOMPSON, *Special Agent in Charge.*
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CONTENTS.

	Page.
Introduction.....	7
Improvements.....	7
Acquisition of additional land.....	8
Notes on native live stock.....	8
Native cattle.....	8
Native carabao.....	12
Native ponies.....	13
Native hogs.....	13
Native chickens.....	14
Introduction of American live stock.....	15
Progress of breeding experiment.....	16
Cattle.....	17
Horses.....	20
Hogs.....	21
Chickens.....	21
Notes on corn growing in Guam.....	22
Corn experiments.....	23
Orchard notes.....	24
Mango propagation.....	24
The peach.....	25
The kumquat.....	25
The amatungula.....	25
The banana.....	25
Seed and plant distribution.....	26
New quarantine regulations.....	26
Work with the honeybee.....	27
Temperature records.....	28

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Fig. 1.—Native calf two days old. Fig. 2.—Native-Jersey cow owned by station.....	12
II. Fig. 1.—Carabao cow and calf. Fig. 2.—Typical native pony.....	12
III. Fig. 1.—Native pig "ras-n-lansa." Fig. 2.—Native pig "ras-n-chabot." Fig. 3.—Pigs showing Native-Berkshire cross, bred and raised by the station.....	12
IV. Fig. 1.—Native fowl, "frizzled." Fig. 2.—Native fowl, "Saigon." Fig. 3.—Native fowl, "mixed"	12
V. Fig. 1.—Ayrshire bull, John Gray. Fig. 2.—Morgan stallion, Cassius.	24
VI. Fig. 1.—Inarched mango, Guam × Saipan. Fig. 2.—Fruits of <i>Carissa arduina</i>	24

TEXT FIGURES.

FIG. 1. Map of agricultural experiment station, island of Guam.....	9
2. Temperature chart of Netherhall King B.....	18
3. Temperature chart of John Gray.....	19
4. Temperature chart of Willowmoor Queen Bess.....	19
5. Temperature chart of Willowmoor Red Rose.....	20
6. Temperatures at Guam Station, July to December, 1911.....	28
7. Temperatures at Guam Station, January to June, 1912.....	29

ANNUAL REPORT OF THE GUAM AGRICULTURAL EXPERIMENT STATION FOR 1912.

By J. B. THOMPSON, *Special Agent in Charge.*

INTRODUCTION.

The progress made during the year along the various lines of station work has been generally satisfactory. The increasing public interest shown by a steady growth in the number of inquiries concerning agricultural problems and by the rapidly multiplying number of applications made for seeds and plants not procurable elsewhere on the island is especially gratifying; and these indications point to a growing confidence in the value of the station work. The past year marks the beginning of the station's efforts toward live-stock improvement, and the interest taken in this phase of the work may be gathered from the service records of our breeding stock, which appear further on in this report. Much, however, in the direction of arousing interest is yet to be desired. Our experience in dealing with the native planter indicates that while he may become interested in the production of a new fruit or vegetable to the extent of obtaining seeds or plants, it generally requires true enthusiasm to lead him to plant and give proper and timely cultivation. This is equally true in all lines of agricultural work and farm practices; yet, making due allowance on this account, the results actually obtained are encouraging. One of the most apparent and readily recognized examples of results obtained is the quantity of vegetables and other crops grown from seeds and plants obtained at the station. Benefits very much more lasting, though not so quickly manifest, will undoubtedly result from the distribution of fruit trees of a perennial nature, the breeding of animals to the superior breeding stock maintained at the station, and it is hoped from the ultimate adoption in general of the better farm practices demonstrated in the station work.

IMPROVEMENTS.

A small but conveniently constructed new residence building has been erected on the station grounds during the latter part of the fiscal year 1912, and was available for occupation at the close of the year. This improvement not only furnishes respectable quarters for the employees at the station, but also provides a home close at hand,

insuring the presence of some of the workers at the station at all times. This latter object has grown more and more pressing with the growth of the station, and since the acquisition of live stock the constant presence of some one has become almost imperative.

A small potting house and propagating shed has also been added to the station improvements within the year. The need of a building of this nature has been seriously felt, and this one adds much to the facilities for handling work in plant propagation.

An open shed suitable for housing wagons and other vehicles and implements in daily use has also been constructed.

ACQUISITION OF ADDITIONAL LAND.

Through the kindness of ex-Gov. G. R. Salisbury, a tract of land consisting of 130 acres was transferred from the island government for use of the station during the past year. This land, which adjoins the original station tract (fig. 1), is mostly rough grazing land; but with the present increasing number of live stock to feed the station is in serious need of more land and can use this additional tract to good advantage.

NOTES ON NATIVE LIVE STOCK.

NATIVE CATTLE.

The history of the cattle industry of Guam is known to date back more than two centuries, and it is probable that the earliest importations were made from Mexico. The present stock is inferior, small and lean, and of an unfixed type. The individuals of this class are variable in color, conformation, and size. Weights of mature cows generally range between 500 and 750 pounds, and those of mature males usually vary between 600 and 1,000 pounds, the latter weight seldom being attained. The weight of the calf at birth is from 25 to 40 pounds. The small spotted calf illustrated in this report (Pl. I, fig. 1) was 2 days old at the time the photograph was taken, and weighed 28 pounds.

The present unimproved condition of the native strain undoubtedly results from a combination of causes, chief among which are a general lack of care and an indifference toward the selection of breeding animals, and this latter cause involving a long period of indiscriminate inbreeding. In this connection a practice that works in direct opposition to improvement of the type arises naturally from the uses to which these animals are put. There is a demand for heavy draft animals of great strength for hauling heavy timbers from the forest and for drawing copra to market, and bulls showing the greatest development in size and strength are selected for these purposes. These animals are employed exclusively in performing heavy draft work, and to render them more docile and more easily managed they are

almost invariably castrated. The result of this system is the retention in general of the more poorly developed bulls for breeding purposes.

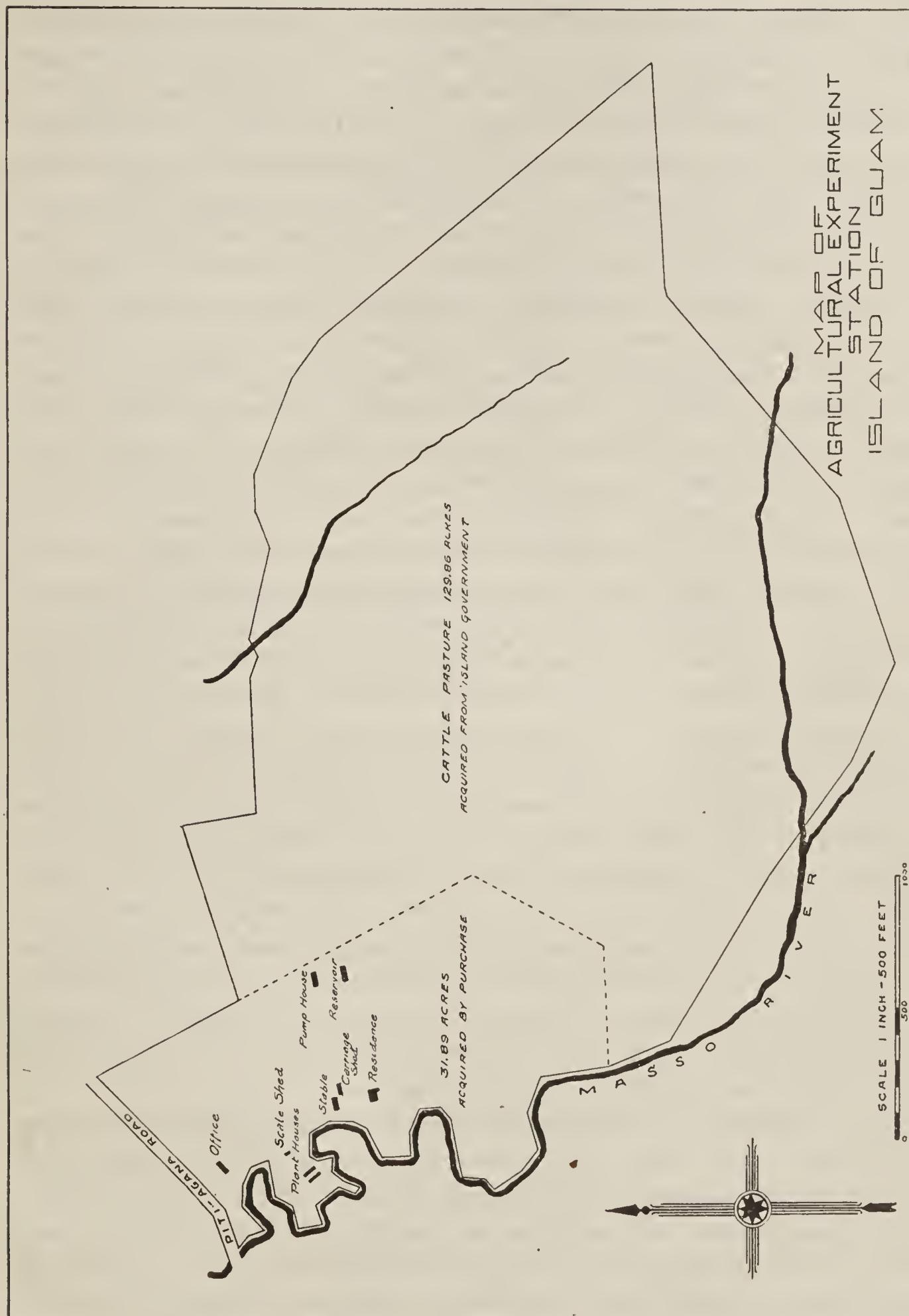


FIG. 1.—Map of agricultural experiment station, island of Guam.

The Guam type is of the straight-backed, humpless *taurus* species; but individuals showing distinct indications of the presence of zebu blood are occasionally observed, pointing to the probable introduction

at some earlier date of animals of the Indian species. Cattle are employed in Guam for draft, carriage, saddle, beef, and dairy purposes, but breeding toward the development of more desirable types for any of these purposes is never practiced.

The milk-producing qualities of the native cow are very inferior as compared with the average cow of the United States mainland, regardless of her breeding. This is due partly to an insufficient supply of nitrogenous food, but more largely to the fact that no systematic efforts have been made toward the development of better dairy strains. Cows kept solely for their milk are comparatively scarce and their management is not conducive to good milk yields. The milk cow of Guam is almost invariably tied to a stake and neglected, often being allowed to remain unchanged for an entire day upon closely cropped pasture, to depend for feed upon such grass or leaves as may be reached within a radius of 25 or 30 feet. Milking is usually performed once daily at irregular morning hours, and the native farmer is wholly unskilled in the method of milking. The calf is never hand fed. It is made fast at night and released after the milk has been drawn from the cow on the following morning. A cow handled in this way naturally holds her milk for the unweaned calf, and the practice of allowing the calf to suck and manipulate the udder for a time until a milk flow is indicated by the distention of the teats is commonly followed. The calf may thus be allowed to suck several times during the milking process, each time sufficient only to encourage the cow to give down her milk. Milking stools are never used. The milker assumes a stooping or squatting position, holding the pail or cup in one hand, and performs the operation by stripping with the thumb and forefinger of the other hand. The milk yield of the native cow seldom exceeds 3 quarts, and the lactation period is of short duration, usually ending by the time the calf is old enough to wean.

The native cattle have good active grazing habits, and when given free run of the range are inclined to fatten easily, even under adverse conditions of pasturage. From the viewpoint of hardiness, although otherwise inferior, these cattle are well adapted to the climatic and other conditions to which they are subjected.

Many favorable conditions obtain in Guam, giving important advantages over most other cattle-growing sections, which would seem to render the cattle industry both attractive and remunerative under an intelligent system of management. Beef is always in ready demand at prices that are good and steadily advancing. A relatively large area of grazing land is available which is of little or no value for other agricultural purposes. The tropical climate renders unnecessary any provision for the shelter of acclimatized stock, and makes the production of green feed possible during all seasons of the year.

Unlike conditions in the Philippine Islands and many other tropical sections, neither foot-and-mouth disease, surra, nor rinderpest exists in Guam. In fact, no contagious or infectious diseases of any nature have been observed among cattle in Guam, and it is certain that none of a seriously virulent nature prevails. In this connection it might be said that both the Texas cattle tick (*Margaropus annulatus*) and the Australian cattle tick (*M. annulatus australis*), the former the carrier of the Texas fever protozoan on the mainland of the United States and the latter reported to be a transmitter of the disease to susceptible cattle in the Philippines, are found in Guam; *but* it is believed that the native cattle are immune to Texas fever. *and*

The prospects of success in the attempt to improve the class of cattle through crossing the native cows with sires of the improved breeds from the United States seem specially promising. Several years ago the naval government imported a number of American milk cows in order to furnish a supply of fresh milk for officers and their families, and while this introduction did not succeed, a few of the offspring mixed with the blood of native cattle are still found, and their superiority over the pure native animal is readily recognized. These cows were of the Jersey breed, and their mixed progeny rank considerably above the native animal in the development of their milking qualities. An example of the improvement brought about by this cross is well shown in a cow belonging to the station, which carries three-fourths native blood and one-fourth blood of the Jersey stock mentioned above. She is remarkably hardy, fully as easily kept as the pure native animal, and weighs 900 pounds when in good condition. She is larger than any native cow on the island. (Pl. I, fig. 2.) A few cows were also introduced a few years ago by American missionaries, and the offspring of these animals show similar improvement.

It is believed that the work of improvement will soon gain favor with the native stock owner, who is quick to recognize quality in a superior animal. The prices of cattle intended for slaughter are based upon the amount of beef they will dress. The draft animal of unusual strength or the cow yielding an uncommonly large quantity of milk is quickly noted, and stories of its performances are told with much enthusiasm.

With the object of giving a more definite idea of the size of the native animals than could be gained from the above statements, weights and measurements taken indiscriminately of a few animals as they happened to be available for the purpose are recorded in the tables following.

Weights and measurements of Guam cattle.

No.	Age.	Sex.	Weight.	Height.	Girth.
	Years.		Pounds.	Inches.	Inches.
1	9	Steer.	615	47	61
2	11	Cow.	555	47	60
3	12	Cow.	630	47	60
4	14	Steer.	715	48	65
5	3	Cow.	535	44	58
6	12	Cow.	495	41	54
7	12	Cow.	445	46	57
8	3	Cow.	480	43	58
9	8	Cow.	590	43	57
10	4	Cow.	410	41	53
11	12	Cow.	525	45	58
12	5	Cow.	490	43	56

Weights and measurements of Guam carabao.

No.	Age.	Sex.	Weight.	Height.	Girth.
	Years.		Pounds.	Inches.	Inches.
1	6	Bull.	855	51	61
2	15	Steer.	1,235	56	81
3	10	Bull.	1,195	56	80
4	12	Cow.	780	51	76
5	9	Bull.	940	51	74
6	4	Bull.	740	51	71
7	20	Steer.	1,435	57	87
8	6	Cow.	1,005	51	78
9	9	Bull.	930	52	72
10	15	Steer.	1,110	54	77

NATIVE CARABAO.

The Indian buffalo or carabao of Guam is identical with the domesticated carabao common throughout the Philippine Archipelago. (Pl. II, fig. 1.) It is a slow, powerful animal, indispensable in the preparation of the muddy rice fields, and well adapted to general farm work requiring great strength rather than speed and especially in wet, cloudy weather or during the cool hours of the day. Carabao, however, do not withstand high temperatures as well as do cattle. This is probably due in part at least to a less delicate anatomical apparatus in the former for regulating the body temperature. The carabao has a thick, tough skin, and does not sweat freely, even when at hard work and on the warmest days of the year. The normal body temperature of the carabao is probably somewhat lower than that of cattle. The writer, while connected with the Philippine bureau of agriculture, had opportunity during the early summer of 1907 to take and record the temperatures of 373 carabao in central Luzon. These animals were apparently in normal health, and were of various ages and of both sexes. Their temperatures, taken at all hours of the day, averaged 100.7° F. The body temperature of the small calf is generally considerably higher than that of older animals, often standing at 102° or higher. Exertion on a warm day seems to cause a marked rise in the temperature of these animals. Temperatures of

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PLATE I.

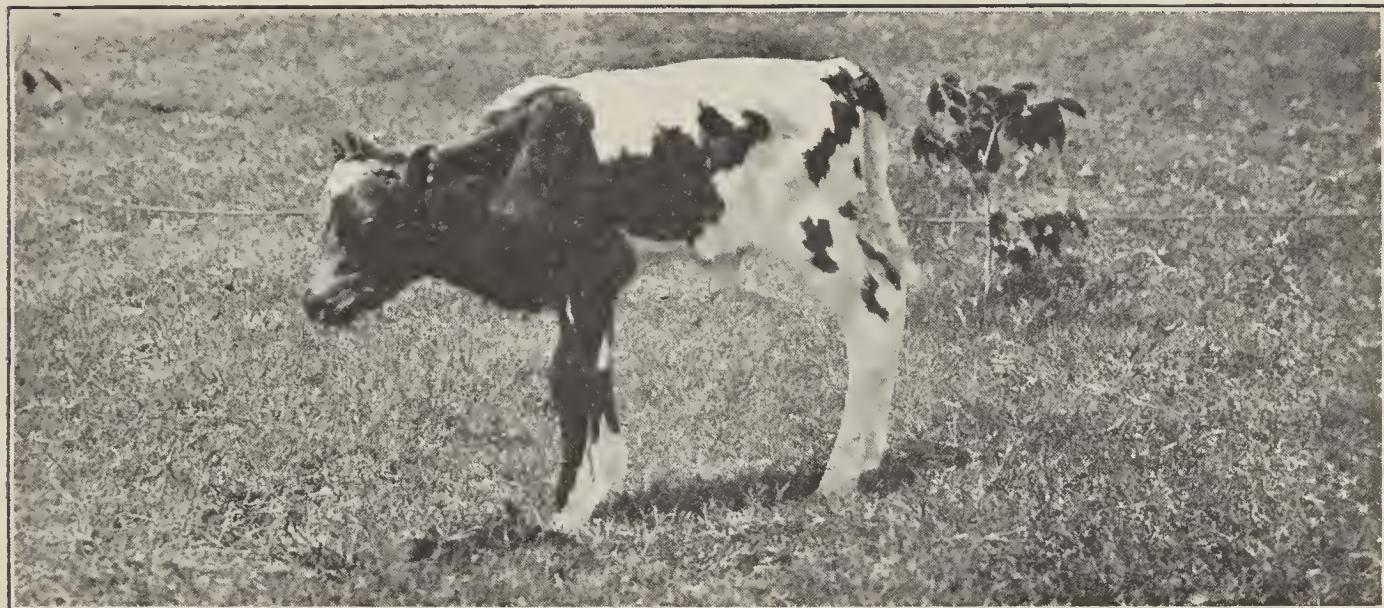


FIG. 1.—NATIVE CALF TWO DAYS OLD.



FIG. 2.—NATIVE-JERSEY COW OWNED BY STATION.

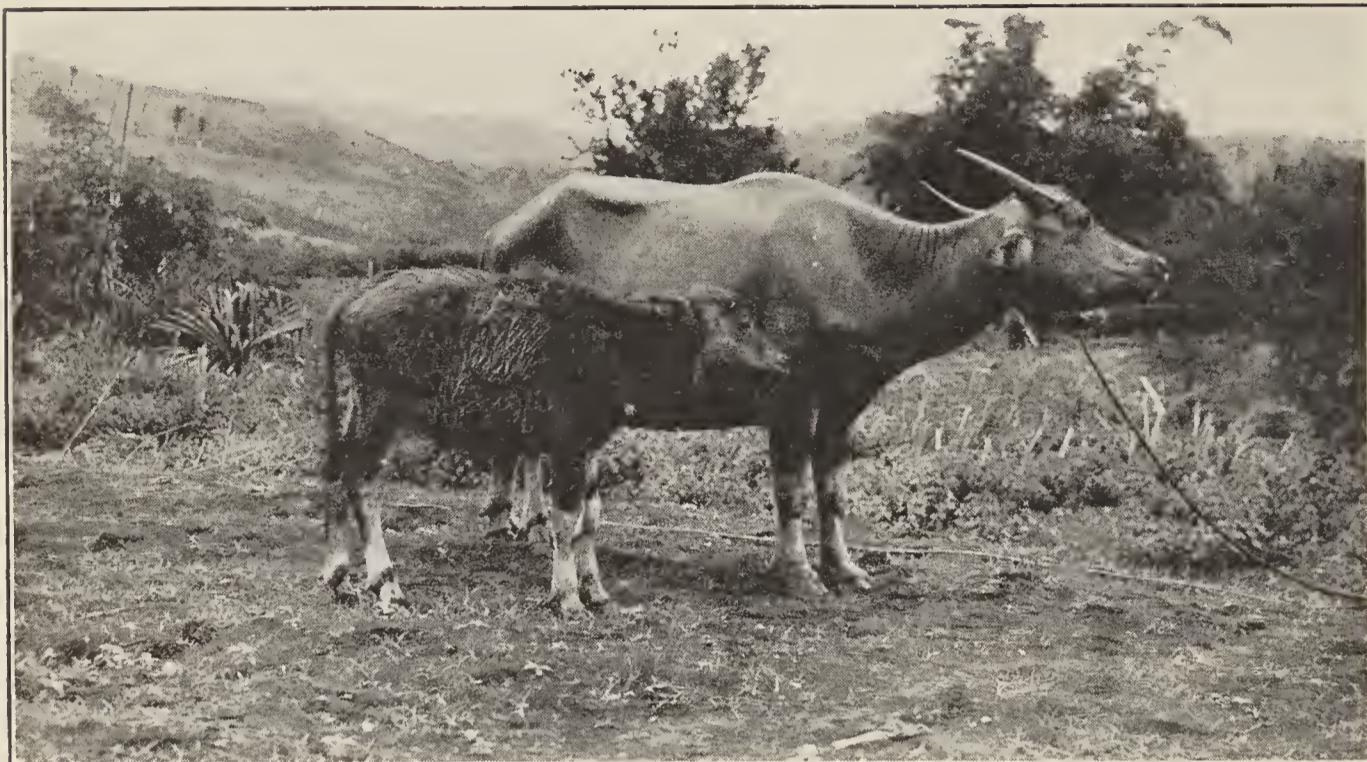


FIG. 1.—CARABAO COW AND CALF.



FIG. 2.—TYPICAL NATIVE PONY.

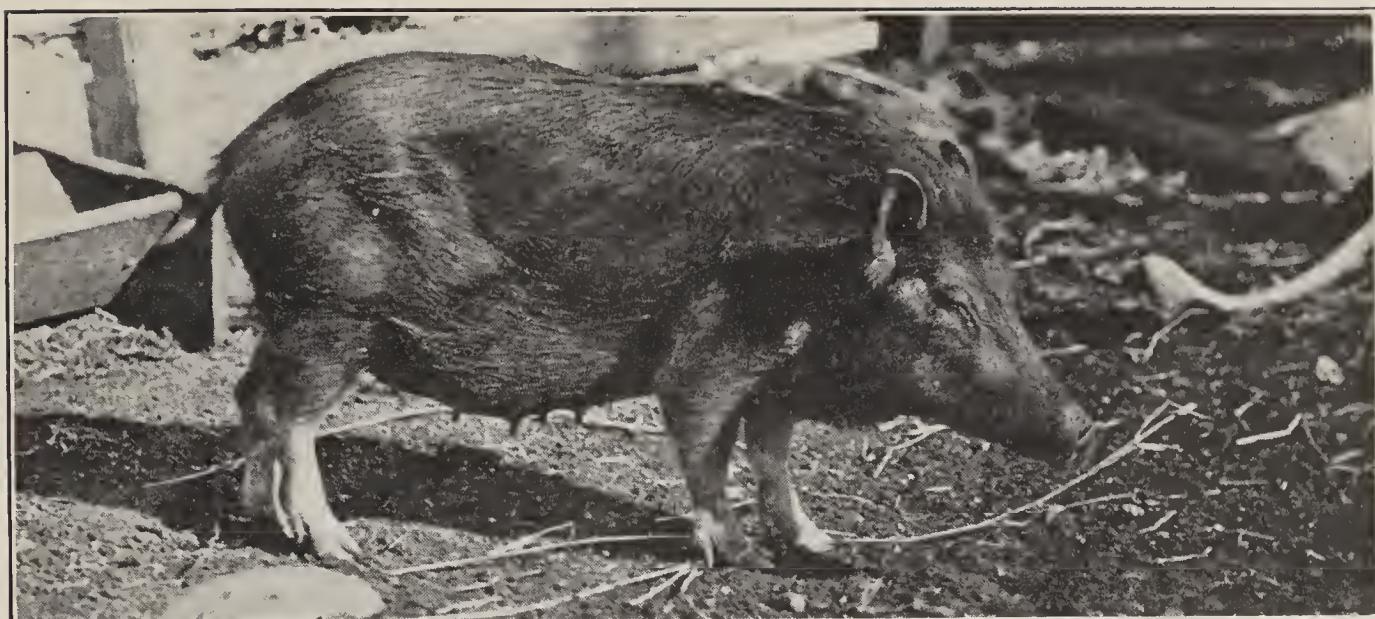


FIG. 1.—NATIVE PIG, "RAS-N-LANSA."



FIG. 2.—NATIVE PIG, "RAS-N-CHABOT."

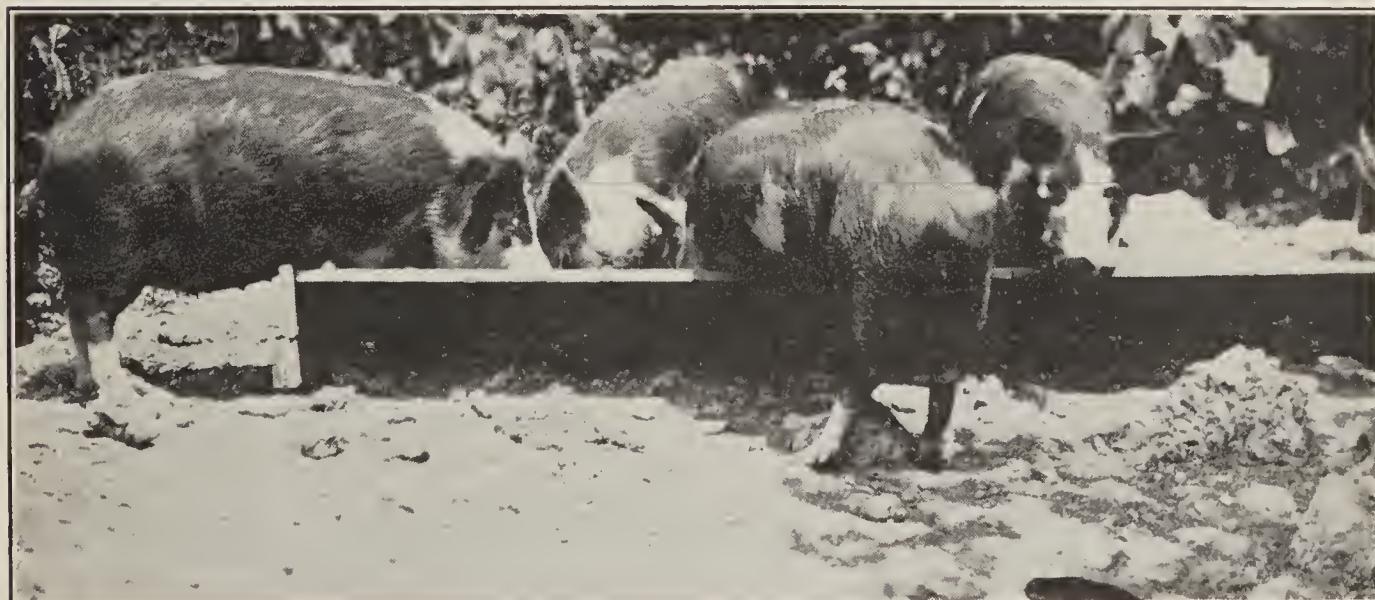


FIG. 3.—PIGS SHOWING NATIVE-BERKSHIRE CROSS, BRED AND RAISED BY THE STATION.



FIG. 1.—NATIVE FOWL, "FRIZZLED."

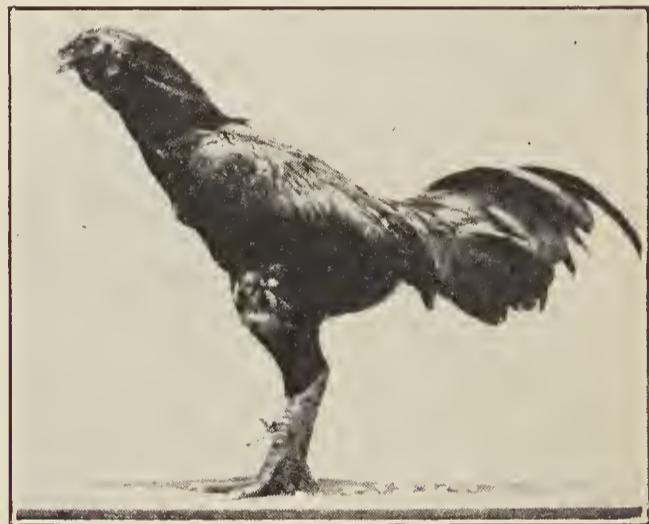


FIG. 2.—NATIVE FOWL, "SAIGON."

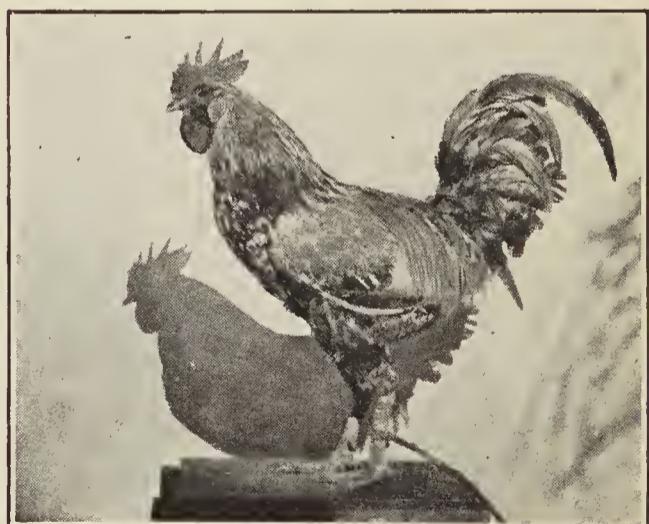
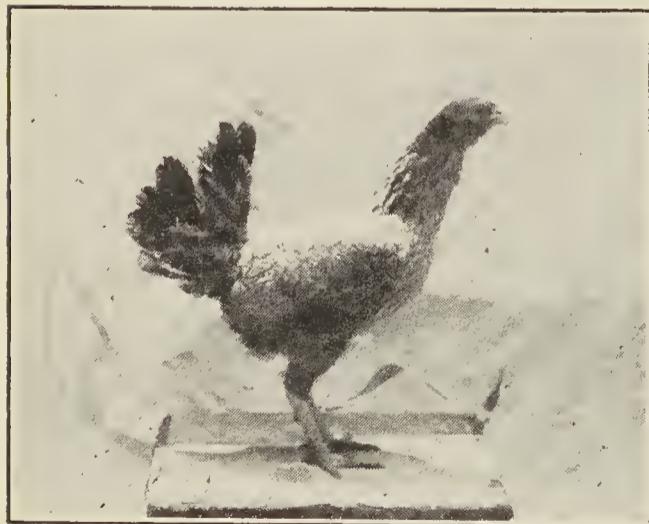


FIG. 3.—NATIVE FOWL, "MIXED."

26 healthy carabao, not included in the number noted above, were taken during the midday hours on June 15, 1907, in the municipality of Mabalacat, Pampanga Province. These animals were all in normal health, and the only exertion to which they had been subjected was a walk to the most central point of the barrio, which in many cases did not exceed a quarter of a mile. The day was intensely hot, and no shelter of any kind was provided the animals, and their temperatures averaged 104.7° F. This inability of carabao to withstand heat renders them less satisfactory work animals than cattle when employed at labor which the latter has sufficient strength to perform. For heavy draft work in the mud the carabao has no equal.

In Guam the carabao is used as a draft animal, for its milk, and for beef. Some of the best milk-producing individuals yield as much milk as the best native cows, and the milk of the carabao is considerably richer in butter fat than that of the cow. Weights and measurements of a few of these animals have been taken at the station, and these appear in the table on opposite page.

NATIVE PONIES.

Aside from animals belonging to the naval government and the shipment of Morgan horses recently imported from the mainland of the United States by this station for breeding purposes, the horses of the island consist almost entirely of small, inferior ponies of Philippine introduction or their offspring. The average pony of Guam is considerably below the average Philippine pony in quality. This is due to the purchase of cheap grades of animals in the Philippines by those who have made importations and to the general lack of knowledge on the part of the Chamorro horse owner concerning the management of this class of animals. The average weight of these ponies is less than 600 pounds. Horses are scarce and in great demand. Excluding Government stock, the number of horses on the island does not exceed 50, and the demand for them is indicated by the fact that these lean, worthless-looking specimens (Pl. II, fig. 2) find a ready sale at prices ranging from \$150 to \$200, United States currency, each. A great deal of pride is taken by the native in the ownership of a horse. These ponies are used almost exclusively for carriage purposes.

NATIVE HOGS.

The hog was one of the earliest domestic animals on the island. Magellan is said to have found wild hogs on the island at the time of the discovery in 1521 and they are still found in the forest-covered area of the northern portion of the island. The domesticated hogs are of two distinct types. One of these types includes animals of a long-

legged, long-nosed, lean, and slow-maturing class, and is known as "ras-n-lansa," meaning the lance race (Pl. III, fig. 1), and no one having once seen the long, tapering snout of a typical animal of this class will question the fitness of the name. Individuals of the "ras-n-lansa" type are similar to the hogs raised in the vicinity of Manila. The sows are unusually prolific and mother their litters well. Animals of the second class are referred to as belonging to the "ras-n-chabot," or the fat race (Pl. III, fig. 2), and differ distinctly from those of the type described above. They are short in body and leg, fine boned, and comparatively easily fattened. The sows usually have small litters and nurse them poorly. The type has probably descended from animals imported from China or Japan.

NATIVE CHICKENS.

A large percentage of the chickens raised in Guam are of mixed breeds. (Pl. IV, fig. 3.) The type most closely approaching a distinct breed is a class known as "Saigon" fowls (Pl. IV, fig. 2), which resemble in some respects the Malay game. These were probably first introduced from French Indo China, and are especially prized for their gameness and good fighting qualities. Other importations have also been made from the Philippines of a similar fowl known in the latter place as a "Jolo," and these, with game chickens having somewhat similar characteristics and coming from various sources, are now known collectively as "Saigons." There are also a few chickens with ruffled or standing feathers, and these are probably descendants of frizzled fowls introduced from Japan. (Pl. IV, fig. 1.) Chickens of both these types are, however, comparatively scarce, and the common native mixed class largely predominates. The ordinary native hen is a poor egg layer. In size she is generally somewhat larger than hens of the Leghorn breeds, but lays a much smaller egg. In the number of eggs produced she is also much inferior to any of the standard breeds raised in the United States. As a class, the chickens of this native mixed type are game, and cocks are often trained for the cockpit, though this custom is practiced to a much less extent in Guam than in the Philippines, where a similar class of chickens exists. In Guam chickens are poorly fed and poorly cared for, and they yield correspondingly poor results. There is always a demand for both eggs and table fowls, and prices seldom fall below 3 cents each for eggs or 50 cents for a mature hen.

A number of serious infectious diseases of poultry are prevalent in Guam, the most troublesome of these being chicken pox, which causes much loss among young growing stock. This disease seems to be most common during the dry season.

INTRODUCTION OF AMERICAN LIVE STOCK.

During the fiscal year 1911 the selection and purchase of an experimental shipment of pure-bred stock was made in the United States by Dr. Walter H. Evans, chief of insular stations, for this station. This lot of animals consisted of 2 young Ayrshire bulls and 2 heifers of the same breed and 4 registered Morgan fillies. Simultaneously arrangements were perfected for the transfer from the Bureau of Animal Industry to this station of 2 young Morgan stallions. These colts, combining good breeding and good individuality, were furnished from the department's Morgan horse-breeding farm at Middlebury, Vt. As the only possible means of effecting the shipment of these animals from the United States to Guam was by the U. S. army transport *Dix*, and the sailing date of that vessel was postponed until September of the past fiscal year, the importation was unavoidably delayed until that time. During this period pending shipment it was found possible to effect the further purchase of 4 good Berkshire hogs, of which 2 were sows and 2 were boars; and a pen each of Barred Plymouth Rock and Single-comb Brown Leghorn chickens were also obtained. On June 29, 1911, the Ayrshire heifer, Willowmoor Red Rose, while being held near Seattle, Wash., for shipment, gave birth to a bull calf. This calf has been registered in Volume XXIV of the Ayrshire Record under the name of Netherhall King B 14591. All these animals finally arrived in Guam on October 12, 1911; and considering the long sea voyage of more than 5,000 miles, requiring in transit a period of 26 days, they reached their destination in remarkably good condition.

The object of this introduction was of a dual nature. First, it was desired to determine the possibilities of establishing these improved breeds in their present purity of blood. It was believed that while imported stock, and especially the cattle, might not thrive well, their progeny bred and raised on the island might prove better adapted to the environment and that increased hardiness might be developed in succeeding generations. It was hoped by this means to develop a strain of animals which, in addition to their many other superior qualities, would also be able to withstand climatic influences and thrive under ordinary treatment. It was also desired to cross these animals with the common native stock with the view to bringing about the general and rapid improvement of the present inferior island types. To this end breeds have been selected which are believed to be best adapted to the general demands of the work, breeds which will probably be as little affected by the change of environment as would any of the better breeds obtainable, and which at the same time are most likely to cross easily and satisfactorily with the native stock.

Descriptive notes which indicate the breeding of the Morgans obtained for use in this work follow:

CASSIUS 5869 (Vol. IV, A. M. R.).

Black stallion, weight at 3 years, 950 pounds.

Foaled May 24, 1909; bred by the United States Department of Agriculture, Middlebury, Vt. *Sire* Red Oak 5249, son of General Gates 666, by Denning Allen 74, son of Honest Allen 73, by Ethan Allen 50. *Dam* Lady Gates (Vol. III, A. M. R.) by General Gates 666, and out of Twilight, a granddaughter of Daniel Lambert 62.

DONALD 6483 (Vol. IV, A. M. R.).

Brown stallion, weight at 2 years, 785 pounds.

Foaled March 19, 1910; bred by the United States Department of Agriculture, Middlebury, Vt. *Sire* General Gates 666. *Dam* Harrison Belle, got by Harrison Chief 1606 (American Saddle Horse Register) and out of Coleman's Eureka 451.

PRINCESS ANGELINE (Vol. III, A. M. R.).

Brown mare, weight at 3 years, 800 pounds.

Foaled May 9, 1909; bred by J. W. Clise, Redmond, Wash. *Sire* Troubadour 5125, son of Jubilee de Jarnette 3857, by Jubilee Lambert 1476, son of Daniel Lambert 62. *Dam* Miss Giffin (Vol. III, A. M. R.), got by Gov. Fisk 397, son of Flying Morrill 3970, by Vermont Ranger 257. *Second dam* got by Sisco Horse, son of General Putnam 304.

KIT OF WILLOWMOOR (Vol. III, A. M. R.).

Light bay mare, weight at 3 years, 800 pounds.

Foaled May 6, 1909; bred by J. W. Clise, Redmond, Wash. *Sire* Troubadour 5125. *Dam* Lady Pearl (Vol. III, A. M. R.), got by Billy Roberts 4550, son of Chase's Mountaineer 676. *Second dam* got by Green Mountain 493, son of Green Mountain Morgan 476. *Third dam* got by Streeter Horse 674, son of Billy Root 9.

EVANGELINE (Vol. III, A. M. R.).

Black mare, weight at 2 years, 775 pounds.

Foaled April 24, 1910; bred by J. W. Clise, Redmond, Wash. A full sister to Princess Angeline.

MAYPORT (Vol. III, A. M. R.).

Bay mare, weight at 2 years, 750 pounds.

Foaled May 6, 1910; bred by J. W. Clise, Redmond, Wash. A full sister to Kit of Willowmoor.

PROGRESS OF BREEDING EXPERIMENT.

At the close of the fiscal year covered by this report the imported stock had been on the island a period of a little less than eight months, during most of which time a season of unusual dry weather prevailed. The following is a report of progress during this period:

CATTLE.

On December 19, 1911, something over two months after the arrival of the stock, the older Ayrshire bull, Willowmoor Moonstone 13466, died from what was believed to be Texas or tick fever.¹ The diseased condition of the bull was first noted six days prior to the date of his death and the symptoms, including a distinctly blood-stained condition of the urine, were characteristic of the disease just mentioned. The remaining animals were immediately clipped with a horse-clipping machine and all were found to be infested with minute ticks so small as to escape detection under an ordinary heavy coat of hair. Native cattle had occasionally gained access to the grounds and it was discovered that not only the pastures but also the grass plats which furnished soiling grass for the stock were badly infested with ticks. A careful daily examination of each individual animal was thereafter made, and when ticks were present these were removed by hand picking. In view of the loss of the bull Willowmoor Moonstone the general infestation of the premises with ticks caused considerable anxiety and it was planned to attempt the immunization of the remaining animals with blood from the native stock. Unless, however, these animals could be kept in a state of absolute cleanliness from ticks for a period of 10 or 12 days prior to inoculation, this course was considered too dangerous, and as we were compelled to depend upon station-grown grass for forage this was found impossible. The plan of inoculation was therefore abandoned and hand picking the ticks was continued. After about four months of these precautionary measures it was believed that the stock had acquired natural immunity and less care was exercised toward keeping them clean of ticks.

Daily temperatures of the cattle were also taken dating from the death of the bull, to which attention has already been called, in order to detect the first indications of disease should it develop in any of them. From December 22, 1911, to the close of the fiscal year these temperatures have been recorded and these records furnish interesting data for study. Periods of abnormally high temperatures have been observed in each of the various animals. Some of these high temperatures at least can not be attributed to reactions caused by tick infestation. The writer has had opportunity to note the ill

¹ Mention should be made here that before the introduction of these animals was undertaken, island conditions, and especially in so far as they applied to the presence or absence of contagious or infectious diseases, were carefully considered. The presence of both Texas cattle tick (*Margaropus annulatus*) and the Australian cattle tick (*M. australis*) was previously determined by collections made by this station and identified by Dr. Charles S. Banks, entomologist of the Bureau of Science, Manila, P. I. Whether the protozoan which is the direct cause of the disease was present or not could not be definitely determined, and work conducted by the United States naval hospital to that end failed to disclose its presence. In the light of these uncertainties, it was considered inadvisable to risk the introduction of the Texas-fever organism by the purchase of immune cattle, and thus imperil the present cattle-raising industry of the island.

effects which often follow the importation of American cattle into the Philippines. To the extent of his knowledge, extensive temperature records following these introductions have never been kept, and it seems possible that such fever periods may be common in cattle elsewhere undergoing similar processes of acclimatization. It is regretted that the station was not prepared to make blood counts during these periods of high temperatures. The following clinical charts (figs. 2, 3, 4, and 5) give the data obtained from the temperature observations.

At the time of shipment of these animals from Seattle to Guam the heifer Willowmoor Queen Bess 25344 was in an advanced stage of pregnancy, and on January 22, 1912, she dropped a dead calf. This calf, a bull weighing 70 pounds, was fully mature and whether

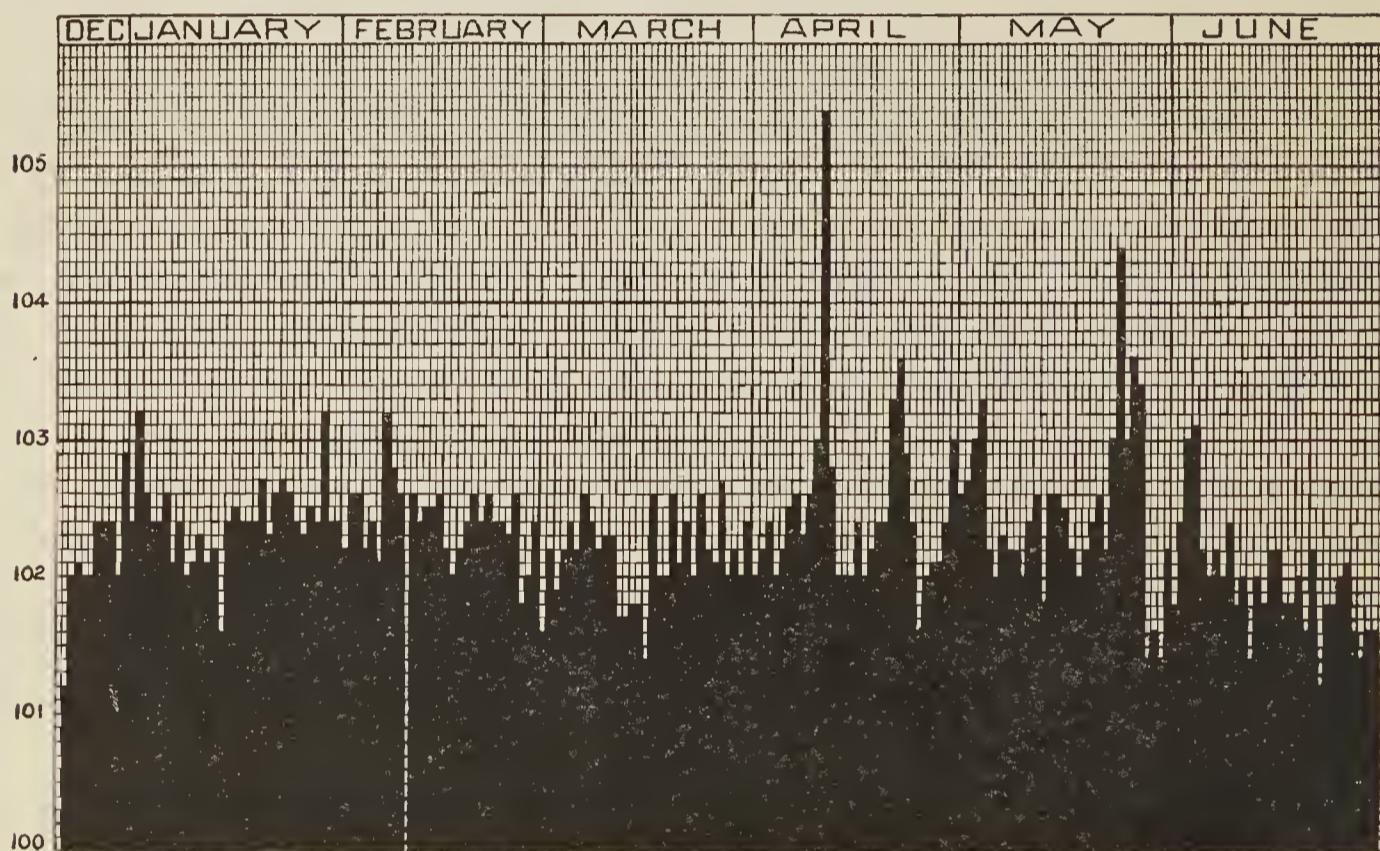


FIG. 2.—Temperature chart of Netherhall King B, bull calf 6 months old at beginning of record.

its death before birth was due to the same cause which produced a feavered condition of the cow during the week prior to birth (see fig. 4) can not be proved. Aside from this misfortune and the loss of the bull the cattle have collectively made a very satisfactory showing. The two cows have held up fairly well in milk production and at the same time have maintained a fair condition of flesh. At the close of the fiscal year both cows were pregnant. The animals have attracted considerable interest among owners of live stock and as much breeding work as was advisable with the one young bull has been accomplished. The bull Willowmoor John Gray 13478 (Pl. V, fig. 1) has a breeding record of 23 services to his credit for the eight months ending June 30 of the fiscal year herein reported, and in that time he increased in weight from 630 pounds to 835 pounds. The photograph was taken at the close of the fiscal year.

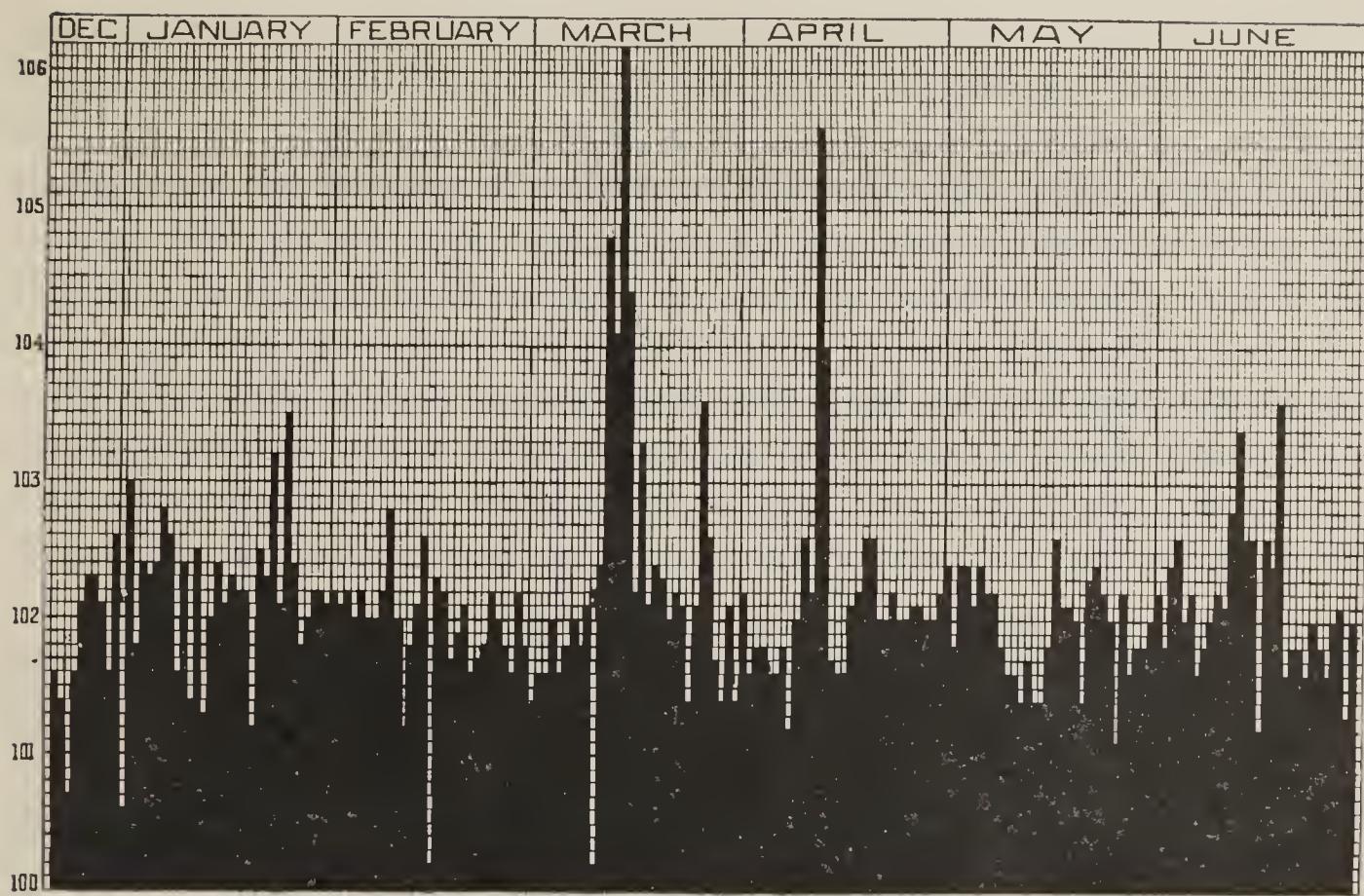


FIG. 3.—Temperature chart of John Gray, bull 16 months old at beginning of record.

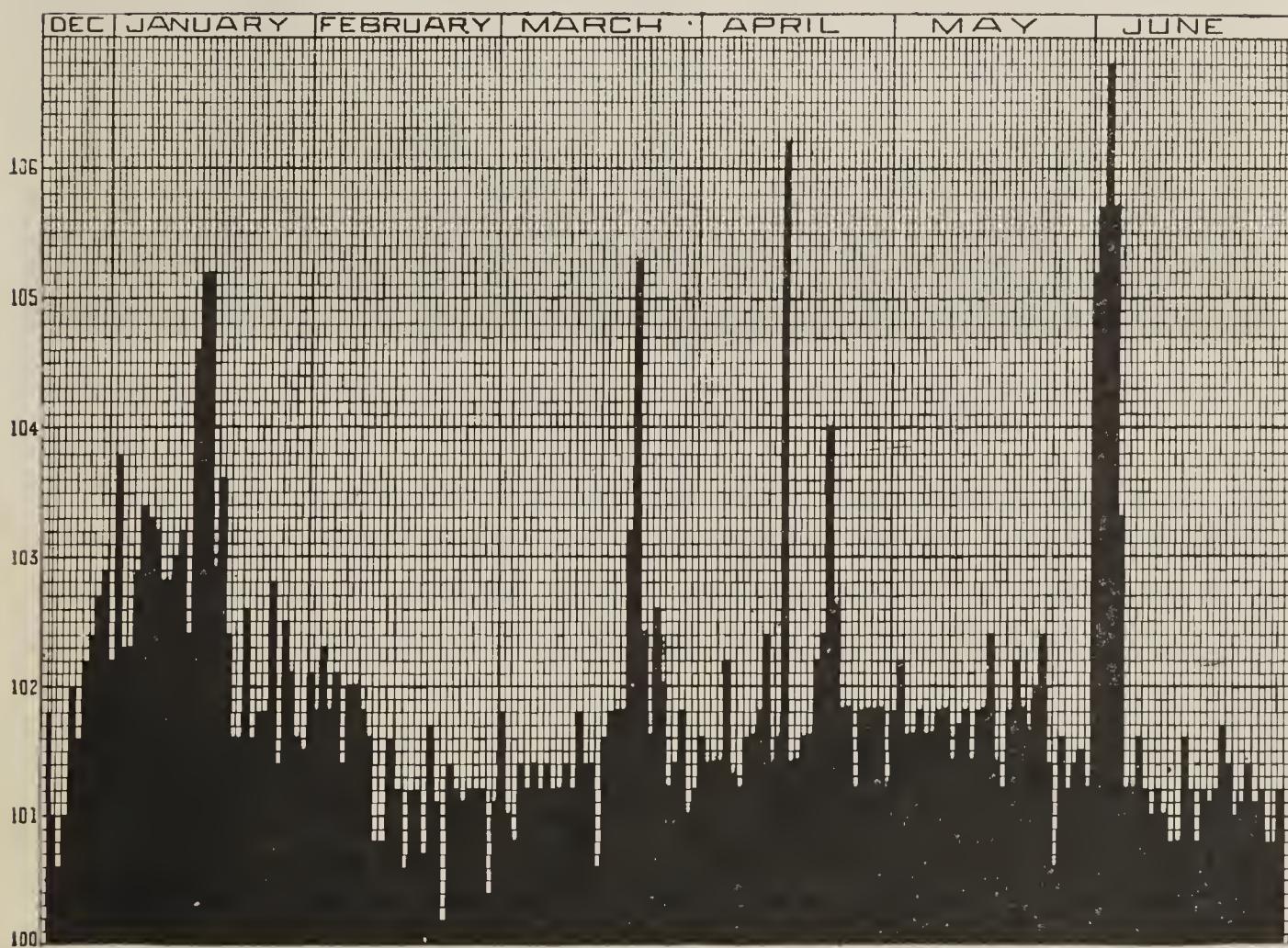


FIG. 4.—Temperature chart of Willowmoor Queen Bess, heifer 38 months old at beginning of record.
Gave birth to dead calf January 22. In milk from January 22 to end of record.

HORSES.

The condition of the Morgan horses has continued from the time of their arrival to the end of the fiscal year to be fully as good as was expected. With the exception of a few minor injuries which have caused more or less difficulty of treatment the animals have remained in a good state of health and vigor. There is a strong tendency in this climate for any small scratch or other trifling wound of the skin to become infected and in consequence to be slow in healing. For this reason the horses have demanded much more attention than would have been required in caring for the same number of animals under conditions existing in most parts of the United States. The work so far indicates that horses, at least, while not at heavy

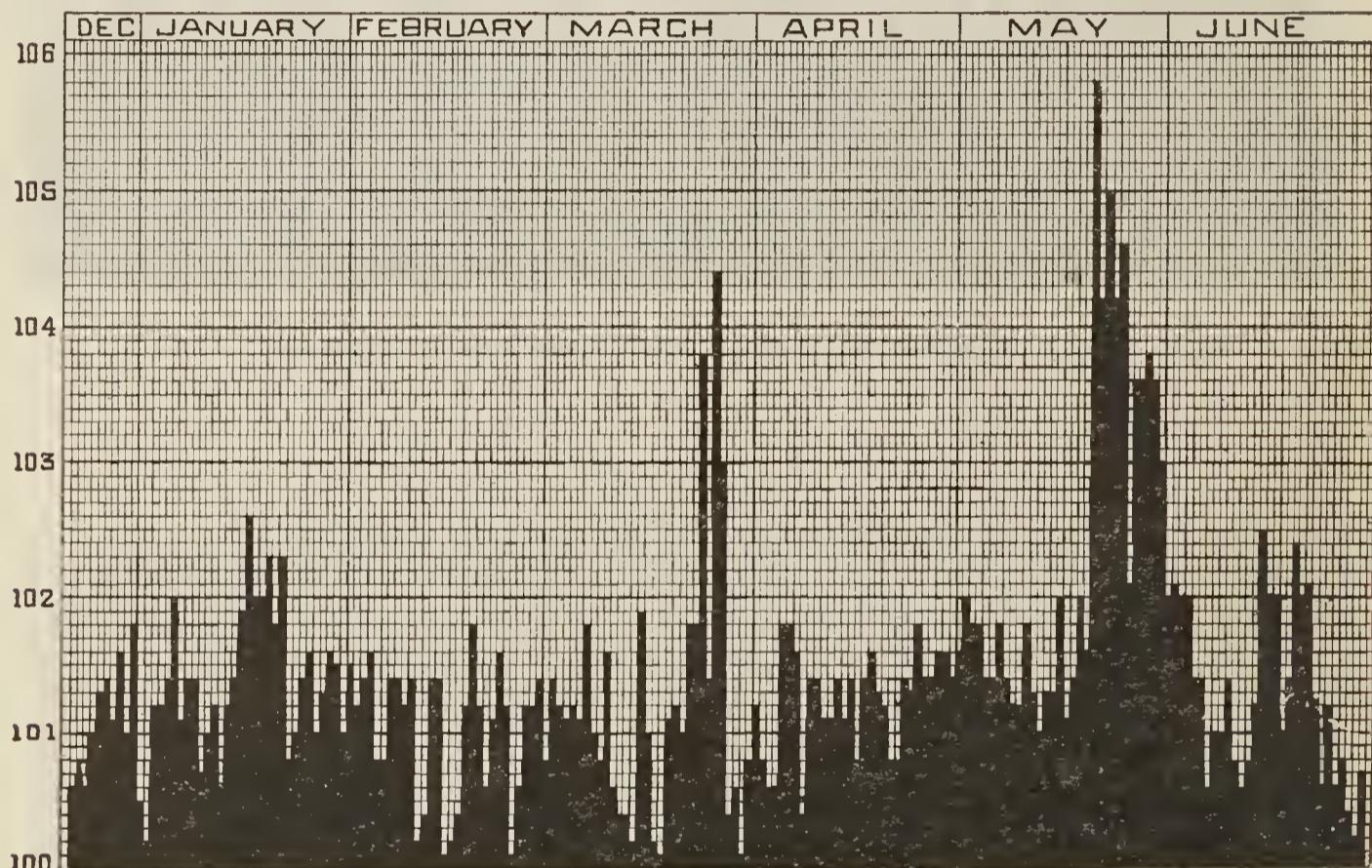


FIG. 5.—Temperature chart of Willowmoor Red Rose, cow 33 months old at beginning; in milk throughout period of record. Decided loss of appetite last of May.

work may be maintained with no further roughage than such as may be produced on the island at a comparatively small expense. The production of a satisfactory grain feed is a problem which will require further investigation and will probably entail greater difficulties.

A limited number of mares have been bred to the young stallion Cassius. All the station mares have been bred, but only one of these has proved to be pregnant. Several native mares belonging to outside parties have also been bred, and most of these are said to be in foal. The illustration of Cassius shown on another page of this report (Pl. V, fig. 2) is from a photograph taken after the close of the fiscal year and is intended to show his condition after more than a year in Guam.

The station has recognized the fact that under ordinary conditions the live-stock farmer will not find the use of imported feeds practicable, and from the beginning we have adopted the policy of depending as largely as possible upon island-grown feed. Practically all the roughage as well as a considerable portion of the grain fed to both horses and cattle during the past year has been produced on the station grounds.

HOGS.

The Berkshire hogs have remained in good health during the course of the year. All have made satisfactory gains, but both of the sows have failed to breed. Twenty-two sows were bred to the two boars during the season beginning with the time of their arrival and ending with the close of the fiscal year. A number of these sows had farrowed prior to the end of the year and the pigs generally showed a marked improvement over the ordinary native pig. (Pl. III, fig. 3.)

CHICKENS.

So far the results with the Barred Plymouth Rock and Brown Leghorn breeds are favorable. Hens of both breeds have proved much better layers than the native hens, and the eggs of the former breeds are also much larger than those of the latter. Chicken pox has caused considerable loss at the station, but the native chickens seem to be fully as susceptible to the disease, and, due probably to less careful management, the mortality among native chickens in the neighborhood of the station was considerably higher than among the newly introduced breeds at the station.

A small incubator has been in operation at the station during the last half of the year. Although the machine is simple of adjustment and the temperature is easily controlled, satisfactory hatches have not been obtained, and it seems probable that climatic conditions in Guam exert an influence over incubation which will necessitate special manipulation of the machine.

The intrinsic utility of these breeds in Guam will depend largely upon the manner in which they thrive under the ordinary conditions to which chickens are subjected here, and with a view to reaching a practical determination of this point such eggs as were not required at the station for hatching purposes were given out in general distribution to those desiring to set them. A total of 438 eggs were thus distributed during the course of the year. The results of this work should give early indications of the practical value of these breeds as compared with the native strains when raised under similar environments and given the same care and attention.

The complete egg record of each pen of pullets from the time they began to lay until the close of the year is given in the following table. It should be explained that at the time of their arrival these were

young growing pullets and that they did not begin to lay until several weeks after their arrival.

Egg record for the fiscal year 1912.

Months.	6 Brown Leghorn pullets.	5 Plymouth Rock pullets.
November.....	2	0
December.....	26	0
January.....	97	12
February.....	125	53
March.....	132	127
April.....	106	92
May.....	76	49
June.....	49	38
Total.....	613	371

NOTES ON CORN GROWING IN GUAM.

Corn, now the most important food crop of Guam, has been grown and utilized for food purposes for a period of more than 200 years. The original introduction of corn into Guam is said to have been made from Mexico,¹ where it had been grown under climatic conditions not widely different from those which obtain in Guam. Now at least this old strain shows much greater adaptation to local environments than the highly improved varieties grown on the mainland of the United States, which do not succeed in Guam. Prior to introductions recently made by this station there was but a single variety grown on the island, a hard, flinty, white corn with broad, shallow grains and a large white cob.

There are two general corn-planting seasons. The principal crop is planted in April or May, dependent upon favorable weather conditions, and the crop develops in the season of comparatively light rainfall preceding the excessively wet period. It reaches maturity in about four months from planting. A second important crop is planted in November or December, following the period of heavy rains, and matures during the period of diminishing rainfall. In addition to these two principal crops a limited quantity of corn is planted at various times throughout the year, these plantings being largely controlled by special conditions which in the dry season furnish a water supply from underground seepage or unusually good drainage in the season of heavy rains.

The cultural methods employed in growing the corn crop in Guam are of the most primitive nature. The fosiño² is almost the only

¹ A number of practices common in the cultivation and use of corn in Guam are evidently adopted from Mexican customs. The system of doubling corn in the field as described on page 23 is also practiced in parts of Mexico. In Guam corn is soaked overnight in limewater to remove the tough outer hull from the grain, when it is ground to a paste between two stones, the metate and the mano, and made into tortillas in much the same manner as is practiced in some sections of Mexico.

² The fosiño is a small hand tool which is constructed and used as a shuffle hoe. Weeds are removed with this tool by a series of thrusts, the blade of the fosiño passing just beneath the surface of the soil.

tool used. It is employed to remove vegetation from the land in preparation for planting and in cultivating the crop by the occasional removal of weeds with a simultaneous stirring of the surface soil. An interesting feature in the cultivation of corn in Guam is the custom of breaking or doubling the stalk just below the ear when the latter has reached a condition of maturity by a partial hardening of the grain. This operation leaves the ear with the point hanging downward and has the effect of hastening the maturity of the crop and prevents the collection of water under the husk, where in the natural position it would be retained, causing germination or decay of the grain. In a climate characterized by high temperatures and heavy rainfall such as obtain in Guam some protective measures are necessary to prevent general loss to the crop, and this practice of doubling the stalk is both simple and effective. Observations on the amount of labor required to perform this operation have been recorded at this station, and these indicate that a man working in corn of average stand and growth will double an acre in four hours.

Corn is not allowed to dry in the field, but is gathered and shelled before drying. This practice renders machine shelling impossible, and the entire product of the island is shelled by hand. As an evidence of the uncured state in which corn is gathered a shrinkage equal to 31 per cent of the original newly husked corn has been noted at this station during the process of drying. An acre of corn grown at the station produced 27.75 bushels of corn; and this yield is considerably better than the average crop grown in Guam. Corn is bought and sold in terms of "tinajas," a measure equivalent to about 98 pounds, or less frequently in "kabans," each of which is equal to about 154 pounds. Prices demanded generally range from \$1 to \$2 United States currency per tinaja.

CORN EXPERIMENTS.

An interesting test of more than 40 different varieties of corn obtained from a wide range of distantly located tropical sections has been in progress during the past fiscal year and it is hoped that through this work varieties of superior merit and adapted to Guam conditions may be found. The corn grown in this test represented a wide variety of types, grading from the small-grained, flinty, variegated sorts from India, Ceylon, Burma, and Formosa, to the large-grained, soft, floury, mummy corns from Ecuador and Colombia. These two groups, representing the extremes with regard to hardness of grain, are also most widely variant in size of kernels, the group from southern Asia requiring from 200 to 220 grains to weigh an ounce, while a variety from Ecuador required 55 grains to constitute an equal weight.

Among the varieties under trial No. 576, a hard, smooth-grained, yellow corn from the island of St. Vincent, and No. 589, a similar

variety obtained from St. Lucia, are promising. Number 576 has produced fully as heavy yields as the common native variety, and the corn of the former was matured in a season 30 days shorter than the period required to ripen a crop of the ordinary native corn. If, as it is hoped, the habit of early maturity remains unchanged in this variety under its new environment, it should meet with immediate popularity. A variety of corn having desirable characteristics in general and which offers in addition the advantages of an unusually short season is of special importance in Guam. Plantings are often retarded by the lack of sufficient moisture at the proper season for planting, and the four months required to produce a crop of the native variety pushes the harvest well forward into the season of heavy rains, and the yield is, consequently, materially reduced. Severe winds or typhoons frequently occur, causing considerable damage to growing corn, and the dangers of loss from this cause are in proportion to the length of time required to mature the crop. This new variety of corn also possesses the advantage of hardness of kernel and seems to be more easily stored in the ear and more resistant to the ordinary grain or rice weevil (*Calandra oryzæ*) than is the common native variety. Much interest has been shown in this new corn, and a limited amount of seed has been distributed. A comparatively large quantity of seed will be available for further distribution during the coming year.

ORCHARD NOTES.

MANGO PROPAGATION.

Work on the propagation of the mango was taken up during the past year. The supply of this favorite fruit is always inadequate to the demand; and there is a ready market for all available fruit at prices of from 5 to 10 cents each. The conditions in Guam are favorable for the production of this fruit, and there seems no reason why all local demand could not easily be fully supplied.

Two polyembryonic races of this fruit are grown in Guam. The one most widely grown and the older from a viewpoint of its introduction into Guam is similar and probably identical with the "caraboa" mango of the Philippines. The fruit of this type is of excellent flavor, and its only serious faults are its light-fruited habits and the long period required to grow fruiting trees from seed. The latter of the two faults can easily be rectified by graftage, and it is believed that its light-bearing properties may also be partially corrected by working it upon the stock of the other type, locally known as the "Saipan" mango. The Saipan mango tree yields a small fruit which contains a considerable quantity of fiber and is decidedly lacking in flavor. As compared with the former type, trees of this race

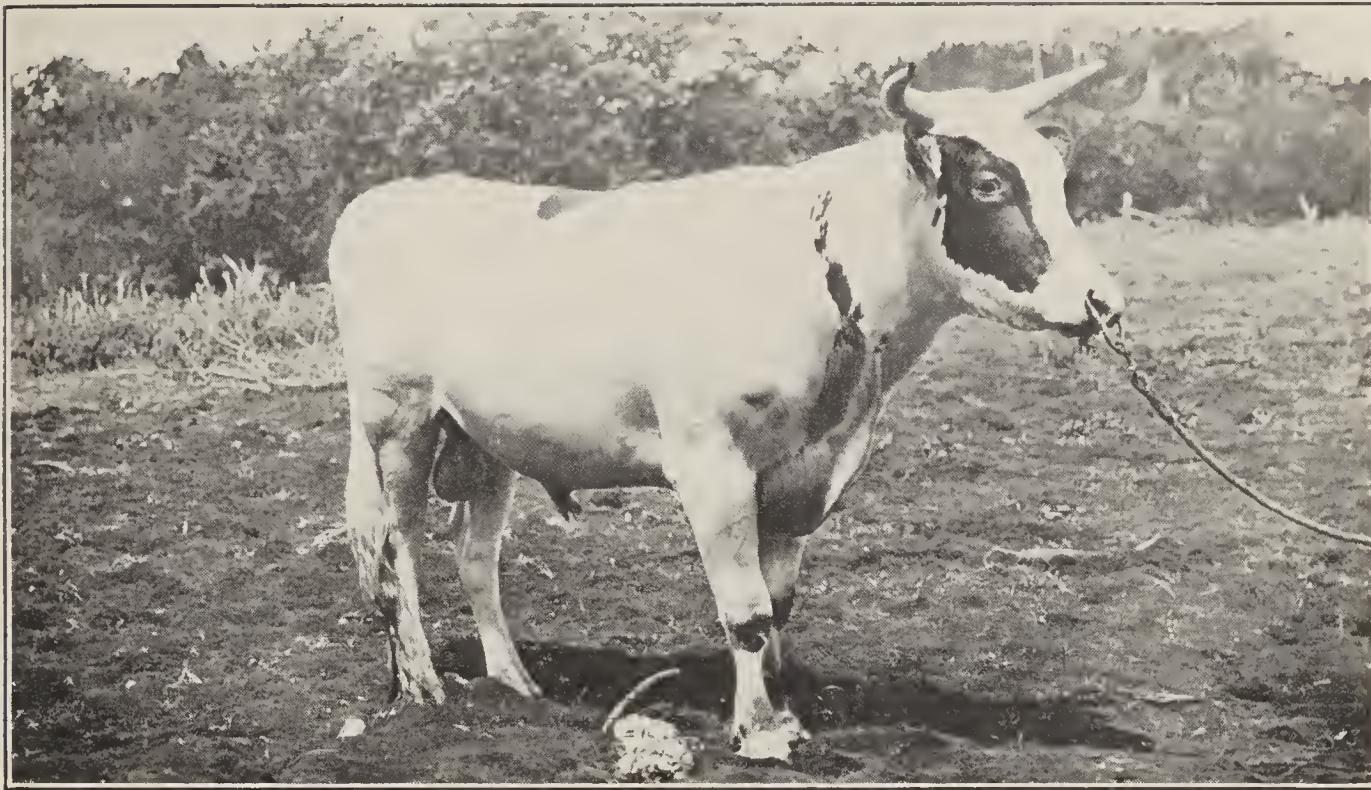


FIG. 1.—AYRSHIRE BULL, JOHN GRAY.



FIG. 2.—MORGAN STALLION, CASSIUS.



FIG. 1.—INARCHED MANGO, GUAM X SAIPAN.

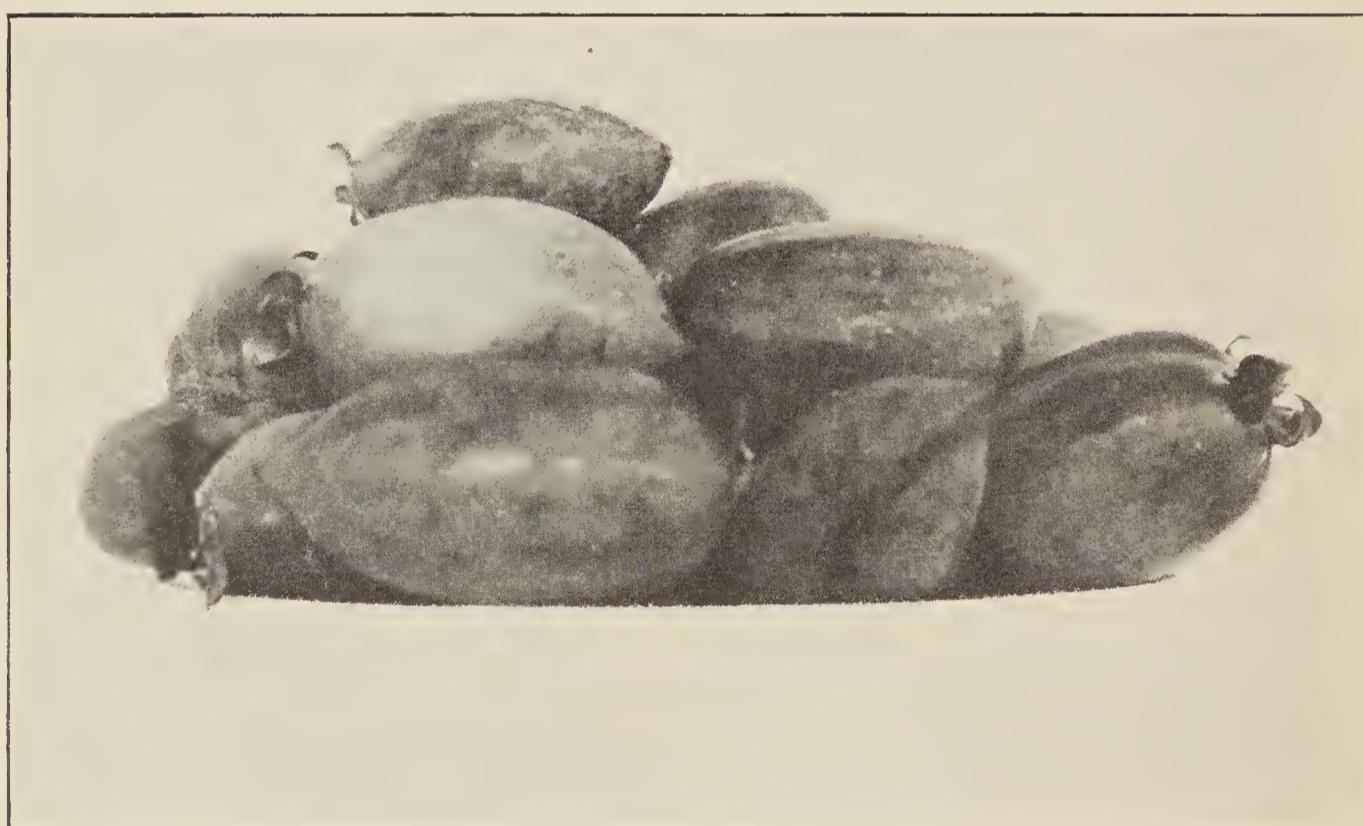


FIG. 2.—FRUITS OF CARISSA ARDUINA.

are less vigorous growers and should prove valuable stock upon which plants of the superior type might be worked. The tree of the Saipan mango fruits at an early age and is a prolific bearer. Our work has so far been limited to propagation by inarching, as this is the simplest operation in general use, and our object is the production of desirable trees for distribution rather than to determine the comparative values of the various methods of propagation. Several hundred seedlings of the Saipan mango are available for a continuation of this work during the ensuing year. (Pl. VI, fig. 1.)

THE PEACH.

During the early half of the year the peach trees referred to in the report for the preceding year suffered some damage from severe winds which occurred on July 20 and October 19, 20, and 31. A few trees were killed outright by these storms, while others sent out new growth from the seedling stock below the bud. These new sprouts made remarkably rapid growth, and the trees soon developed their former size. Near the close of the year some of these trees bloomed, but failed to set fruit.

THE KUMQUAT.

The kumquats (*Citrus japonica*) introduced from Japan at the close of the preceding year give every promise of success. They have flowered and fruited constantly during the last few months of the year, and small fruits have been removed in large numbers in order to encourage the development of good strong trees. This fruit shows indication of being a most prolific bearer in Guam.

THE AMATUNGULA.

The seedlings of this species (*Carissa arduina*) bore their first crop of fruits at two and one-half years of age. (Pl. VI, fig. 2.) They have been rather shy bearers during their first fruiting season, carrying constantly a light crop of flowers and fruits in all stages of maturity during the last six months of the fiscal year. These plants are growing on a heavy black clay soil and will probably show better results when removed to grounds less retentive of moisture. Considerable interest in the new fruit has been made manifest by applications for plants. A limited number of plants have already been distributed, and several hundred seedlings are being grown at the station. These will be available for distribution within the next few months.

THE BANANA.

Both the Bungulan and Lacatan varieties of the banana previously introduced from the Philippines have fruited, and the flavor of both has generally been declared superior to that of the varieties com-

monly grown in Guam. All available plants of these varieties have been given out in general distribution, and the supply has been kept constantly reduced.

The Brazilian and Jamaica or Bluefields varieties have been introduced from Hawaii within the past year.

SEED AND PLANT DISTRIBUTION.

During the past year there has been a greater demand for seeds and plants than during any similar period in the history of the station, and a comparatively large quantity of seeds has been furnished planters who applied for them. Due to climatic causes, special difficulties are met with in the preservation of seeds from season to season; and these conditions in conjunction with the absence of seed firms on the island from whom seeds might be obtained when desired render the distribution of seeds a decidedly important branch of the work of encouraging more general and more diversified plantings. In addition to the distribution of seeds, about 2,500 seedlings, rooted cuttings, and inarched plants have been distributed from the station during the past year. The bulk of these distributions consisted of plants propagated at the station from seeds or cuttings of valuable plants which have been reported among previous introductions.

NEW QUARANTINE REGULATIONS.

Early in the fiscal year two important executive general orders having the effect of law were issued by the governor of Guam with the object of avoiding the introduction of plant diseases and insect pests into Guam. A general quarantine law restricting the importation of plants and providing for the fumigation of such plants as were allowed to enter was deemed by Gov. Salisbury imperative to the agricultural welfare of the island; and accordingly Executive General Order No. 167 was issued on July 21, 1911, to provide this needed protection. Soon after this the ravages on the island of Oahu of the introduced Mediterranean fruit fly indicated a special danger from that source, and Executive General Order No. 168 was issued on August 24, 1911, prohibiting the shipment into Guam of all Hawaiian fruits. As these orders are of special importance they are both reproduced, as follows:

EXECUTIVE GENERAL
ORDER No. 167. }

It is hereby ordered and decreed that:

In order to prevent the introduction of insect pests into Guam the importation of all live plants, bulbs, tubers, cuttings, and of all other live parts of plants other than seeds is prohibited, except such as may be imported for food purposes, and except further that a limited number of useful plants may be introduced by the United States Department of Agriculture for use at the Government experimental farm. Plants for the experimental farm shall be imported only on a permit signed by the governor; and

GOVERNMENT HOUSE,
Island of Guam, July 21, 1911.

the request for such permit shall show the number and kind of plants desired. All plants thus introduced must be accompanied by certificate showing that they have been inspected and fumigated immediately prior to shipment. Upon arrival at Guam such plants must be fumigated and inspected.

Executive General Order No. 125 is hereby revoked.

G. R. SALISBURY,
Governor of Guam.

EXECUTIVE GENERAL
ORDER NO. 168. }

GOVERNMENT HOUSE,
Island of Guam, August 24, 1911.

It is hereby ordered and decreed that:

(1) For the purpose of preventing the introduction into Guam of insect pests, particularly the Mediterranean fly, the importation of all fruit from the Hawaiian Islands is absolutely prohibited.

(2) Any passenger or member of crew of any Army transport or other vessel arriving from the Hawaiian Islands who introduces into Guam fruits from the above islands is guilty of a misdemeanor and is liable therefor.

(3) Any resident of Guam who introduces or receives fruit from the Hawaiian Islands shall be punished by a fine not exceeding one hundred dollars (\$100).

G. R. SALISBURY,
Governor of Guam.

WORK WITH THE HONEYBEE.

Considerable attention has been devoted to the study of methods of handling the honeybee. A number of modern Langstroth hives, the only ones on the island, have been introduced by the station and a number of hives have been kept at the station for the purpose of demonstrating to visitors the proper methods of handling bees and producing honey. No little interest has been manifested in the work and a number of modern hives and other bee-keeper's supplies have been obtained for interested parties by the special agent. A few years ago a colony of bees was introduced into Guam from Honolulu by the naval government and the large number of colonies now kept in cracker boxes, soap boxes, and similar containers, as well as the many colonies which have escaped and taken possession of hollow trees, etc., throughout the island, are all descendants of this one original colony. In addition to a continuation of our demonstration work the introduction of queen bees of new strains is projected for the coming year. While the periods affording the greatest possibilities in the collection of honey are distinctly seasonal in Guam, the tropical climate allows the production of a limited amount of honey during all seasons of the year. Honey is held in high esteem by the people and an increased supply will result in the substitution of a greater quantity of these home-produced sweets for the expensive imported sugar, which is used in comparatively large quantities. There is also a possibility of developing a profitable wax industry on a small scale. An important factor in favor of bee-keeping in Guam is the total absence of foul brood and all other serious hive pests.

TEMPERATURE RECORDS.

Records of maximum and minimum temperatures at the Guam Station throughout the year ending June 30, 1912, are shown in the following charts (figs. 6 and 7):

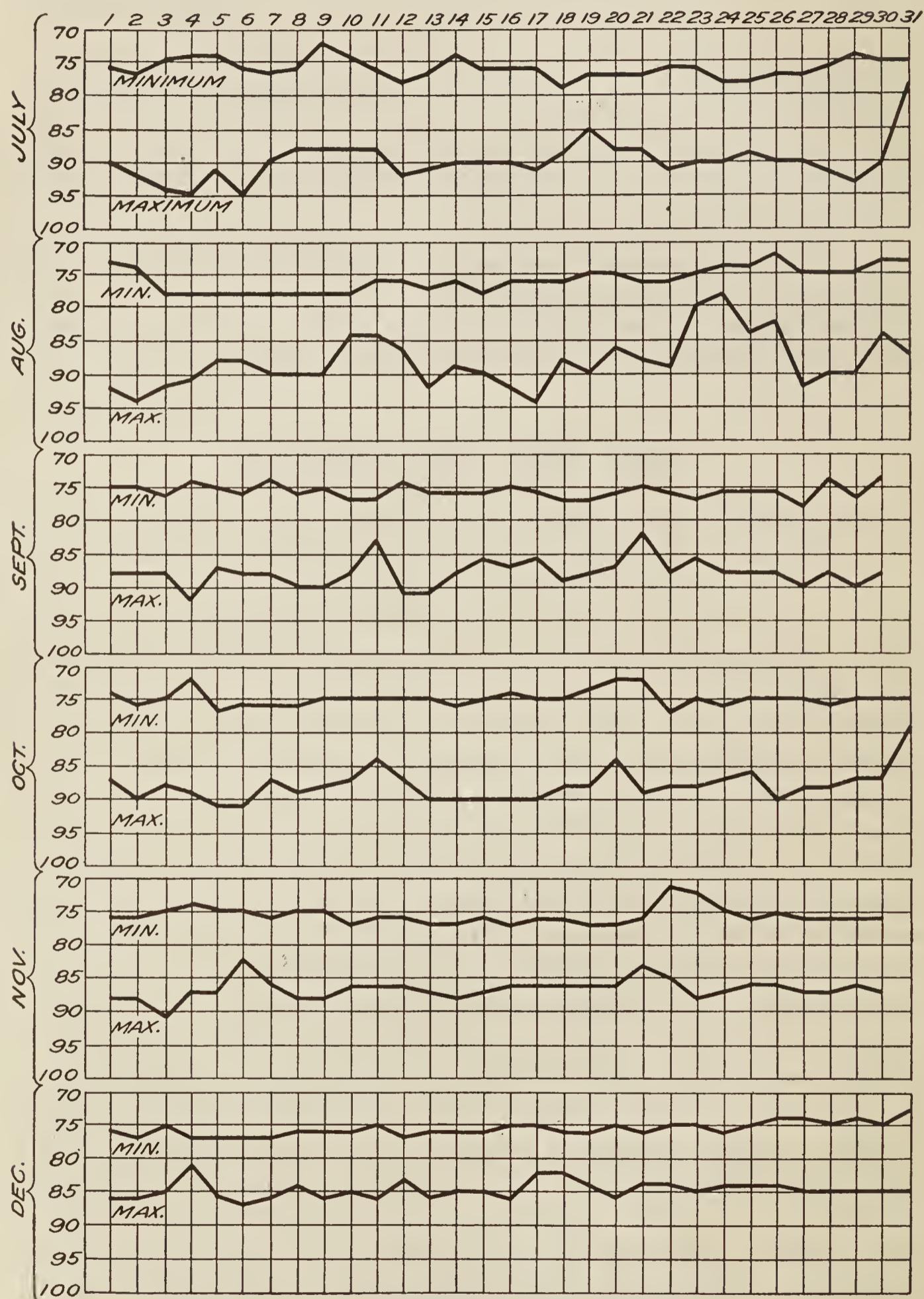


FIG. 6.—Temperatures at Guam Station, July to December, 1911.

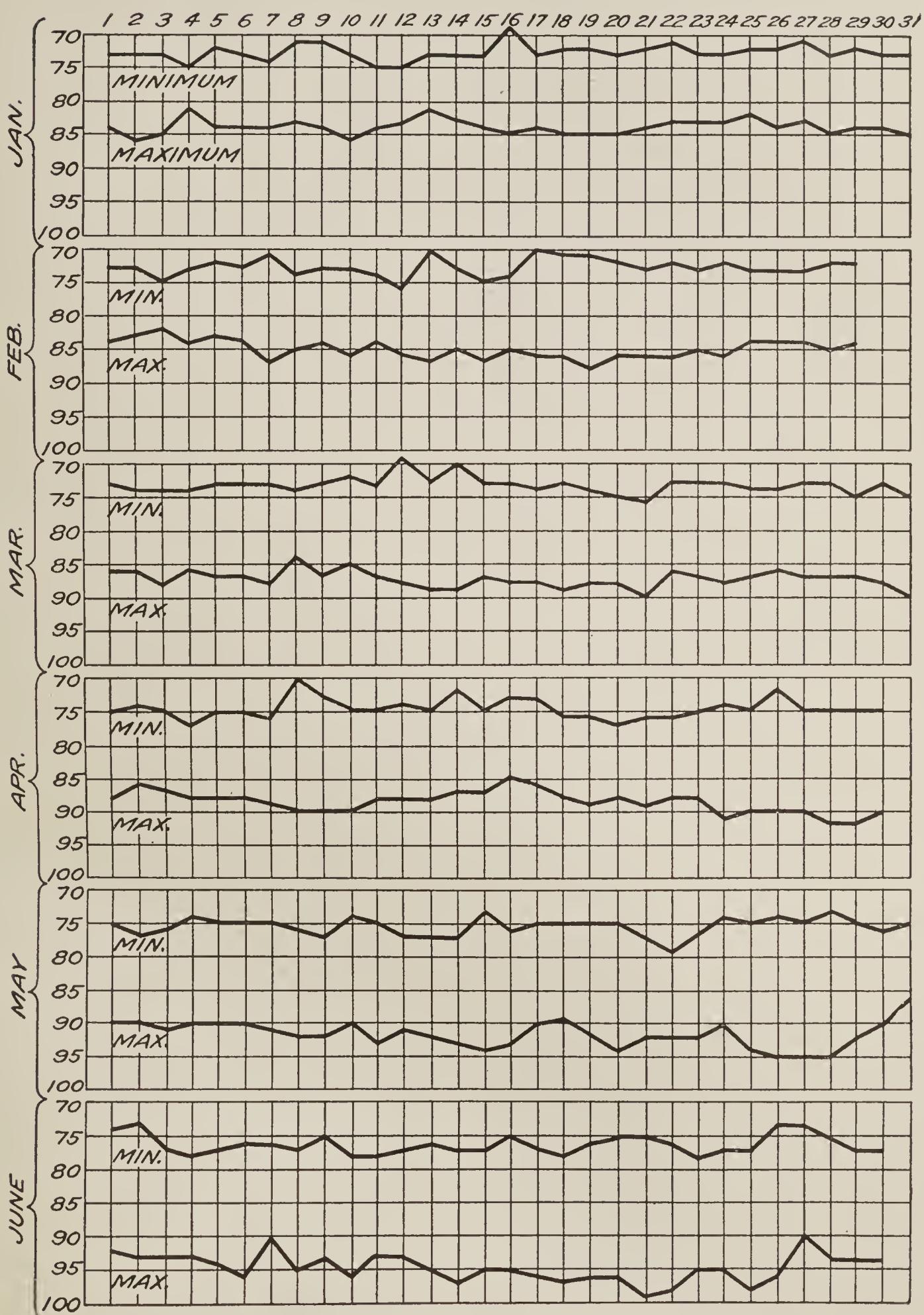


FIG. 7.—Temperatures at Guam Station, January to June, 1912.

